C1.00060 Self-Assembly of CdSe Nanorods by Controlled Solvent Evaporation and Applied Electric Field , SIRINYA CHANTARAK, TODD EMRICK, THOMAS P. RUSSELL, Polymer Science & Engineering Department, University of Massachusetts, Amherst — We report the synthesis of CdSe nanorods (NRs) having variable aspect ratios and their vertical alignment into a hexagonal arrays over a large area. NRs with a constant diameter of 6 nm and lengths, tunable to over 100 nm, were obtained by controlling the concentration of ligands in solution and injection of Se at defined time intervals. Hexagonal arrays of aligned, alkane covered CdSe nanorods within a polymer matrix were achieved by controlled solvent evaporation in the presence of an applied electric field. The nature of the solvent identity, substrate hydrophobicity, and strength of applied voltage were optimized such that close packing of nanorods was achieved over a large area. Such organized nanocomposites hold potential application in organic-inorganic bullk heterojunction photovoltaic devices.

C1.00061 Emulsions of Polymer Blends Stabilized by Janus Particles , KYLE BRYSON, RYAN HAYWARD, THOMAS RUSSELL, University of Massachusetts - Amherst — Particle-stabilized emulsions of both immiscible and partially miscible polymer blends have recently received renewed interest. In particular, bicontinuous stabilized emulsions are attractive for their three-dimensional expression of the properties of each component, but a true incarnation of this structure has yet to be demonstrated in polymer systems, due to the difficulties in preparing particles that neutrally wet both polymer phases. Janus particles, which possess different surface chemistries on two halves of the particles, afford a way to bypass the necessity of neutral wettability. Both theory and experiment have shown enhanced interfacial adsorption energies for Janus particles, in comparison to homogeneous particles. To investigate these concepts, silica particles were homogeneously and anisotropically functionalized and dispersed in fluid mixtures; interfaces were created by thermally induced phase separation or mechanical mixing. The resulting structures were characterized by laser-scanning confocal microscopy and transmission electron microscopy. The results elucidate the role of particle wettability on the structure of stabilized emulsions.

C1.00062 Crystallization of Polymers at liquid/liquid interface templated by single-walled carbon nanotubes , WENDA WANG, CHRISTOPHER LI, Drexel University, SOFT MATTER RESEARCH GROUP TEAM — Nanosized single-walled carbon nanotube rings were fabricated by using a Pickering emulsion-based method. By tuning a water/oil/SWNT miniemulsion system, SWNT rings with a diameter of ~200 nm can be readily achieved. The formation mechanism is attributed to the bending force induced by the curved liquid/liquid interface. Crystallization of polyethylene homo- and copolymers using this unique SWNT rings as the nucleation agent was conducted at the curved liquid/liquid interface. Crystal structure, hybrid morphology and crystallization kinetics were systematically studied. The structure of controlled alternating patterns on SWNT rings has great potential in various applications in large-scale integrated circuits and single-electron devices.

C1.00063 Effect of Nanoparticle Size on Nanoparticle Spatial Distribution in a Diblock Copolymer Supramolecular Thin Film , PETER BAI, JOSEPH KAO, MATTHEW LUCAS, PAUL ALIVISATOS, TING XU, University of California, Berkeley — The self-assembly of nanoparticles (NPs) opens many pathways towards generation of functional nanostructured materials with desirable optical, mechanical and electrical properties. A great challenge in this field is the effective control of NP spatial distribution within the block copolymer matrix, which is crucial in tailoring the macroscopic properties of the polymer/nanoparticle composites. We systematically investigated the effect of NP size on the spatial distribution of nanoparticles upon blending with a diblock copolymer based supramolecule in thin film. The spatial distribution of NPs in thin film was observed to be strongly dependent on NP size. These observations can be explained by the increase in entropic penalty of incorporating larger NPs associated with the deformation of the BCP block to accommodate the NPs. This effect is observed for NPs with different chemistries and could serve as a promising route to creating multifunctional thin film nanocomposites.

C1.00064 Direct Nanorod Assembly Using Block Copolymer-Based Supramolecules , KARI THORKELSSON, ALEXANDER MASTROIANNI, Department of Materials Science and Engineering, UC Berkeley, PETER ERCIUS, National Center for Electron Microscopy, Lawrence Berkeley National Laboratory, TING XU[1], Department of Materials Science and Engineering, UC Berkeley; Materials Sciences Division, Lawrence Berkeley National Laboratory — One-dimensional nanomaterials with high aspect ratios, such as nanorods, exhibit unique and useful anisotropic optical, magnetic, and electrical properties. The collective properties of 1-D nanomaterials depend on their spatial arrangements, interparticle ordering, and macroscopic alignment. Developing routes to control their organization with high precision is critical to generate functional materials. We have investigated the co-assemblies of nanorods and block copolymer (BCP)-based supramolecules that self-assemble into spherical, lamellar and cylindrical morphologies. By varying energetic contributions from the rod-rod interactions and the deformation of the supramolecule, a wide library of nanorod assemblies including highly aligned arrays, continuous networks, and clusters can be readily accessed. Since macroscopic alignment of BCP microdomains can be obtained by application of external fields, present studies open up a new route to manipulate macroscopic alignments of nanorods. Fundamentally, these studies have demonstrated that in these blends, the energetic contributions from the polymer chain deformation and rod-rod interactions are comparable and can be tailored to disperse nanorods with control over inter-rod ordering and their relative alignment.

[1] Also: Department of Chemistry, UC Berkeley

C1.00065 Magnetically aligned polymers and nanocomposites for energy harvesting and energy storage applications[1] , PAWEL MAJEWSKI, MANESH GOPINADHAN, CANDICE PELLIGRA, Yale University, SHANJU ZHANG, California Polytechnic State University, LISA PFEFFERLE, Yale University, LUIS CAMPOS, Columbia University, CHINEDUM OSUJI, Yale University — The realization of anisotropic, nanostructured, functional materials by self-assembly is impaired by the persistence of structural defects which render the properties of the system isotropic on macroscopic length scales. We present three distinct systems including ZnO nanowire-semiconducting polymer composites, Li-ion conducting block copolymer membranes, and perylene-based block copolymers where self-assembly under a magnetic field yields alignment and global anisotropy of their physical properties. The resulting aligned nanostructured systems are attractive for ordered heterojunction photovoltaics, high performance solid polymer electrolyte membranes and electro-optical devices, respectively. Our results demonstrate that magnetic fields offer a viable route for directing the self-assembly of certain soft functional materials. The ready scalability of this approach makes it potentially important from a technological standpoint.

[1] The funding from NSF under DMR-0847534 and DMR-0934520 is gratefully acknowledged.

C1.00066 Absorption of nanoparticles onto curved surfaces , CHIH-YU JAO, Virginia Tech Dept of Physics, JIHAENG YI, ISHAC L. N. KANDAS, BO LIU, YONG XU, Virginia Tech ECE Dept., HANS D. ROBINSON, Virginia Tech Dept of Physics — We study the adsorption of gold nanospheres onto cylindrical and spherical glass surfaces from stagnant aqueous particle suspensions. The curved surfaces were obtained as tapers and microspheres fabricated from optical fibers and were coated with a nm-thick layer of the polycation polyallylamine hydrochloride, causing irreversible adsorption of the negatively charged spheres. Our results fit well with theory, which predicts that the rates of particle adsorption will depend strongly on the surface geometry. In particular, *adsorption is significantly faster on curved than on planar surfaces* at times long enough that the particle diffusion length is large compared to the surface curvature. This is of particular importance for plasmonic sensors and other devices where particles are deposited from a suspension onto surfaces which may have non-trivial geometries.

APS March Meeting 2012
Boston, Massachusetts
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Bulletin of the American Physical Society

APS March Meeting 2012

Volume 57, Number 1

Monday–Friday, February 27–March 2 2012; Boston, Massachusetts

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